mammalian intestine. A sugar- and amino-acid-dependent increase in net Cl^- flux generates a serosa-negative potential. Glucose causes an increase in mucosal epithelial Cl^- activity. These findings are explained on the basis that Na^+-glucose cotransport initiates a significant increase in mucosal membrane permeability to Cl^-.

The final section is on Cl^- transport in vertebrate tissues. This consists of articles on ion transport in winter flounder intestine by E.J. Krasny and R.A. Frizzell in which the influence of the ion-selective shunt pathway is examined. There are also two shorter reviews on Cl^- transport in fish; absorption in shark rectal gland by F.H. Epstein, J.S. Stoff and P. Silva and transport by teleost gill and operculum by K. Degnan.

A novel and interesting article is presented by J.F. White on electogenic-Cl^- absorption and its relationship to HCO_3^- transport in *Amphiuma* small intestine, in which the role of carbonic anhydrase in Cl^- absorption is explored.

There is a long, important review of the mechanisms of chloride transport in vertebrate renal tubule by R. Greger and E. Schlatter, the bulk of which is devoted to the authors' own work on Cl^- transport in isolated perfused rabbit cortical thick ascending limb segments, cTAL. A convincing equivalent-circuit model is presented, in which the e.m.f. across the lumenal membrane is dominated by potassium, and the basolateral membrane is mainly Cl^--conductive, but also contains a rheogenic $3Na^+$-$2K^+$ pump. They deduce that the entire p.d. across the cTAL can be explained by K^+-leak back across the mucosal membrane into the lumen and by the sum of the conductive Cl^- exit across the basolateral membrane and the opposing current carried by the $(Na^+ + K^+)$-ATPase. The role of loop diurectics is examined in relation to this model. This model illustrates beautifully that examination of transport properties of the component membranes of an epithelial system can give an entirely different perspective on the mode of generation of transepithelial p.d. and net ion movements from that derived simply by observing the transepithelial flows.

Cl^- secretion in frog cornea is described in terms of electrical equivalent circuits by O. Candia.

In the last article by T.E. Machen and J.G. Forte, evidence for a parallel KCl symporter and $(H^+ + K^+)$-ATPase in the apical membrane of the oxyntic cell is described. This is preceded by a useful review of the role of Cl^- in acid secretion.

In summary this is a useful, albeit expensive book, which should be of interest to scientists, post-graduates and final-year undergraduates interested in biological transport.

R.J. Naftalin

Electron Microscopy of Proteins

Macromolecular Structure and Function, Volume 4

Edited by J.R. Harris

Academic Press; London, New York, 1984

373 pages. $65

This book is the fourth in a series which is subtitled Macromolecular Structure and Function. As this implies, the emphasis of this series is on insights gained by electron microscopy towards an understanding of structure-function relationships. Hence the systems chosen for examination are complex assemblages of proteins where electron microscopy may make a special contribution. In the present volume the systems discussed are muscle proteins and their associations (Actin and Thin

Filaments by E.J. O'Brien and M.J. Dickens and Myosin Molecules, Thick Filaments and the Actin-Myosin Complex by R. Craig and P. Knight) and membranes (The Proteins of the Erythrocyte Membrane by D.M. Shotton and Plasma Membrane Intercellular Junctions. Morphology and Protein Composition by C.A.L.S. Colaco and W.H. Evans). Rather more than half the book is devoted to the muscle protein systems. These review work of the last fifteen to twenty-five years. The proteins actin and tropomyosin are particularly amenable to electron-microscopic study because of their ability to form crystals, paracrystals or tactoids under a variety of conditions, such as the addition of metal ions, either on their own or in association, such as tropomyosin with troponin or whole reconstructed thin filaments comprising tropomyosin, actin and troponin. Optical diffraction patterns of these arrays which may be filtered to remove noise are then used to form images. Three-dimensional image reconstruction using Fourier methods have been used to give models of the more complex 'arrow-head' structures formed when actin or thin filaments are 'decorated' with a chymotryptic digestion fragment of myosin, known as S-1. These are fascinating structurally, and are especially important, since understanding actin, myosin and ATP interactions and their regulation forms the basis for understanding muscle contraction.

This of course requires a synthesis with results of X-ray studies of whole muscle and with a large volume of biochemical data. The X-ray approach has the advantage that time-resolved studies are possible using high-intensity synchrotron radiation, but rapid-freezing techniques may in future be applied so that successive 'snapshots' of structural changes may be possible in the electron microscope.

Membranes and intercellular junctions are rather less amenable to electron-microscopic study than muscle. Nevertheless, development of freeze-fracture and freeze-etch techniques as well as, of course, negative staining, and the use of ferritin, cationized ferritin or ferritin-conjugated concanavalin A, the extraction and examination of individual proteins and the reconstitution of membrane systems, have allowed a much more sophisticated picture of membrane structure to be built up than the simple bilayer model. Knowledge of intercellular junctions has largely been acquired through electron microscopy, although further developments in membrane biochemistry, immunology and molecular biology will, as the authors of the last chapter state, be required for understanding their fine detail.

The chapters are clearly written and well illustrated. They contain few references beyond 1981.

Pauline M. Harrison

Handbook of Tritium NMR Spectroscopy and Applications

by E.A. Evans, D.C. Warrell, J.A. Elvidge and J.R. Jones

John Wiley & Sons; Chichester, 1985

249 pages. £25.50

Tritium labelling is a well-known technique which has had widespread application in biochemistry. The usual method for detecting the label is, of course, scintillation counting. An alternative method, described in this book, is to use high-resolution nuclear magnetic resonance (NMR). NMR has the considerable advantage that the concentration of a label at a specified position on a molecule can be determined directly. The disadvantage of NMR is its lack of sensitivity, which means that very radioactive samples, of the order of mCi, are required.